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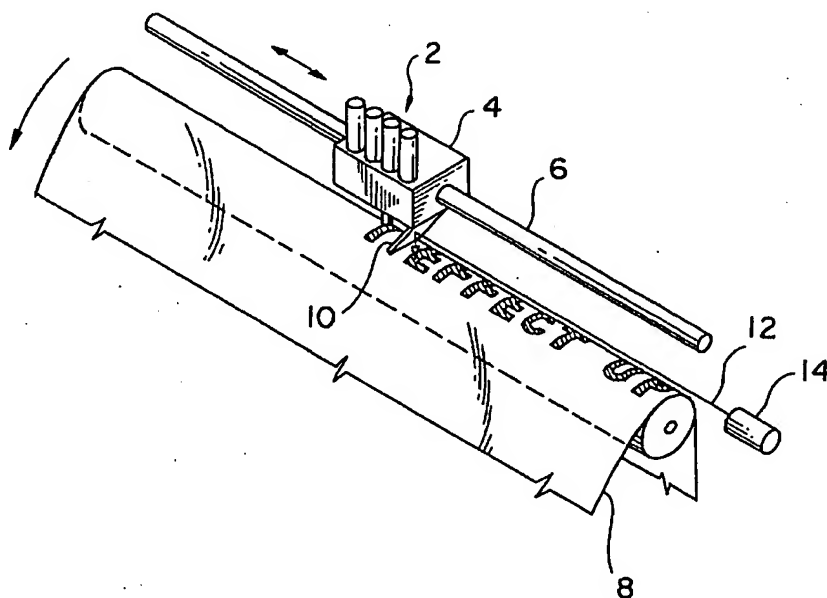
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(54) Title: METHOD AND APPARATUS FOR CURING UV CURABLE COATING



(57) Abstract: An ink-jet applicator comprises a print head (2) including a housing (4); a guide (6) operably secured to the housing (4) to guide the housing across a medium (8) being imprinted; a UV light source (14) disposed at one end of the guide (6) to generate a beam of radiation; and a mirror (10) carried by the housing (4) adapted to reflect the beam onto the UV curable coating deposited by the print head (2) onto the work surface (8).



WO 02/04214 A1

APPARATUS AND METHOD FOR CURING
UV CURABLE INK, COATING OR ADHESIVE APPLIED
5 WITH AN INK-JET APPLICATOR

FIELD OF THE INVENTION

The present invention is directed to an ink-jet applicator using UV curable ink, coating or adhesive and particularly to an ink-jet applicator having means for curing the UV curable ink,
10 coating or adhesive just after it has been deposited onto a work surface.

BACKGROUND OF THE INVENTION

There are several types of print heads which are capable of producing a finely directed stream or droplet flow of ink to a
15 surface which is moving relative to the print head. By applying digitized signals, which has been resolved and rasterized from an image, to the print head, a digital print is produced. Typically, in large-format digital printing, the print head is moving in one direction while the work surface or sheet is moved
20 in a perpendicular direction. These two motions, in combination

with an ink color and impulse signal sent to the print head, produce an image which builds, line-by-line, on the work surface. This method of plotting is well-established and commonly used.

- 5 UV curing of the ink is most effective when applied immediately or as soon as practical after the deposition of the ink. The UV radiance required to cure opaque inks is in the range of 1-20 watts/cm², and may be anywhere in the range of 200 nm through visible light wavelengths. This suggests
- 10 mounting the exposure lamp on the print head mechanism, in order to follow the print closely. However, higher speed printing requires the total mass of the print head be as low as possible.

OBJECTS AND SUMMARY OF THE INVENTION

- It is an object of the present invention to provide an ink-
- 15 jet applicator using UV curable ink, coating or adhesive that provides curing of the liquid immediately after deposition on the work surface.

- It is another object of the present invention to provide an ink-jet applicator for UV curable ink, coating or adhesive with
- 20 the capability of the curing the liquid immediately after deposition while keeping the total mass of the print head relatively low.

- In summary, the present invention provides an ink-jet applicator comprising a print head including a housing; a guide
- 25 operably secured to the housing to guide the housing across a

medium being imprinted; a UV light source disposed at one end of the guide to generate a beam of radiation; and a mirror carried by the housing adapted to reflect the beam onto the UV curable coating deposited by the print head onto the work surface.

5 The present invention also provides a method for curing UV curable coating applied with an ink-jet applicator, comprising providing a print head movable along a guide across a work surface to be imprinted; providing a UV light source at one end of said guide to generate a beam of radiation; and reflecting
10 the beam onto the coating just deposited by the print head onto the work surface.

These and other objects of the present invention will become apparent from the following detailed description.

BRIEF DESCRIPTIONS OF THE DRAWINGS

15 Figure 1 is a perspective of a print head applicator made in accordance with the present invention.

Figure 2 is a front elevation view of Figure 1.

DETAILED DESCRIPTION OF THE INVENTION

Referring to Figure 1, a digital print head 2 includes a
20 housing 4 carried by a guide 6. The guide 6 may include a drive mechanism (not shown) that cooperates with the housing 4 to drive the print head 2 back and forth across the medium or work surface 8. A mirror 10 is carried by the housing 4 and is oriented to reflect a beam of UV light 12 generated by a UV

light source 14. The mirror 10 focuses light onto the work surface 8 in a spot immediately following the print to at least illuminate the series of ink dots most recently applied by the print head. The mirror 10 is disposed at a distance in such a way that it will not interfere with the ink jet itself.

By focusing small, but intense beam of UV light parallel to and along the axis of travel of the print head, and by placing the small mirror 10 to redirect the light to the work surface, the mass required to be added to the print head can be extremely small. The light source may be high intensity but its size and weight do not affect the speed of travel or response at the print head. The focused light remains always in alignment of travel of the mirror, which is oriented at approximately 45° to the incident beam. The mirror may be flat or curved to redirect or concentrate the beam onto the work surface.

Transport mechanisms for the print head are most often bi-directional. In this case, light source 14 may be located at both ends of the head travel in order to precisely illuminate the applied ink after the head has deposited the ink, and do this in both directions of travel, as best shown in Figure 2.

The light source 14 can consist of a traditional light source with focusing and collimating optics, or may be a UV/bis laser. The illuminated area may overlap several passes, thereby providing additional radiant energy to areas previously cured, or partially cured.

The present invention reduces the total radiant energy

required to accomplish the cure of the ink because light of high intensity is focused onto only a small area. Coverage relies on the multi-pass motion of the print head.

While this invention has been described as having preferred
5 design, it is understood that it is capable of further
modification, uses and/or adaptations following in general the
principle of the invention and including such departures from
the present disclosure as come within known or customary
practice in the art to which the invention pertains, and as may
10 be applied to the essential features set forth, and fall within
the scope of the invention or the limits of the appended claims.

I CLAIM:

1. An ink-jet applicator, comprising:
 - a) a print head including a housing;
 - 5 b) a guide operably secured to said housing to guide said housing across a medium being imprinted;
 - c) an UV light source disposed at one end of said guide to generate a beam of radiation; and
 - d) a mirror carried by said housing adapted to reflect the
 - 10 beam onto the UV curable coating deposited by said print head onto the work surface.
2. An ink-jet applicator as in claim 1, wherein said mirror is oriented 45° relative to the work surface and the beam.
- 15 3. An ink-jet applicator as in claim 1, wherein said mirror is flat.
4. An ink-jet applicator as in claim 1, wherein said mirror is curved.
5. An ink-jet applicator as in claim 1, wherein said light
- 20 source is a UV/bis laser.
6. An ink-jet applicator as in claim 1, and further comprising:
 - a) another UV light source disposed at an opposite end of said guide to generate another beam of radiation; and
 - 25 b) another mirror carried by said housing adapted to reflect the other beam onto the UV curable coating deposited by

said print head onto the work surface.

7. A method for curing UV curable coating applied with an ink-jet applicator, comprising:

- a) providing a print head movable along a guide across a
5 work surface to be imprinted;
- b) providing a UV light source at one end of said guide to generate a beam of radiation; and
- c) reflecting the beam onto the coating just deposited by the print head onto the work surface.

10 8. A method as in claim 7, wherein said reflecting is provided by a mirror carried by said print head.

9. A method as in claim 7, wherein said reflecting is provided by a flat mirror.

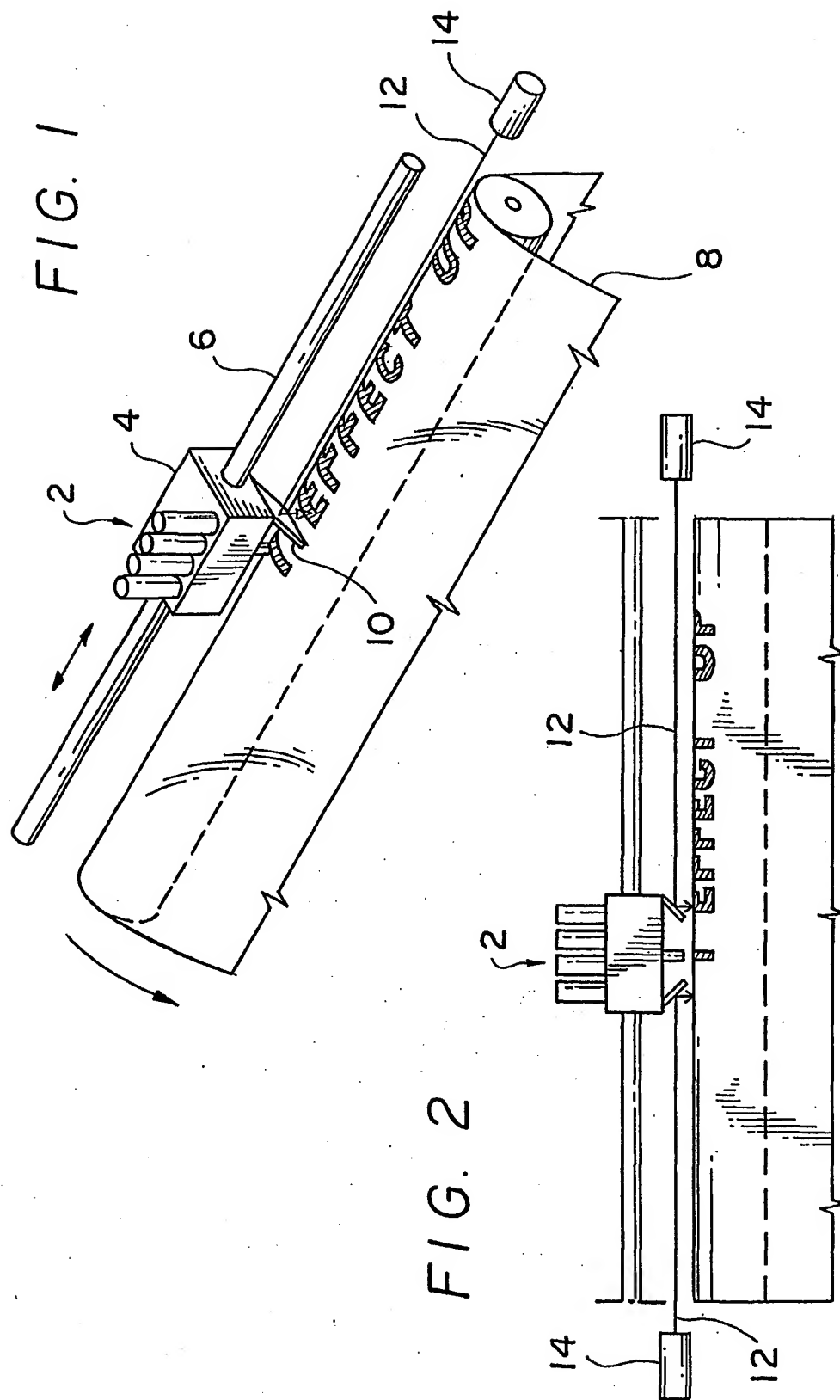
15 10. A method as in claim 7, wherein said reflecting is provided by a curved mirror.

11. A method as in claim 8, wherein said mirror is oriented 45° relative to the work surface and the beam.

12. A method as in claim 7, and further comprising:

- a) providing another UV light source disposed at an
20 opposite end of said guide to generate another beam of radiation; and
- b) reflecting the other beam onto the coating just deposited by the print head onto the work surface.

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : B 41J 2/01

US CL : 347/102

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 347/102

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P X	US 6,145,979 A (Caiger et al.) 14 November 2000 (14.11.2000), column 3, line 15, line US 4,340,893 A (Ort) 20 July 1982 (20.07.1982), column 2, line 17-22	1-3, 5, 7-9, 11, 12 6, 12

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:	"T"
"A" document defining the general state of the art which is not considered to be of particular relevance	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"B" earlier application or patent published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

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